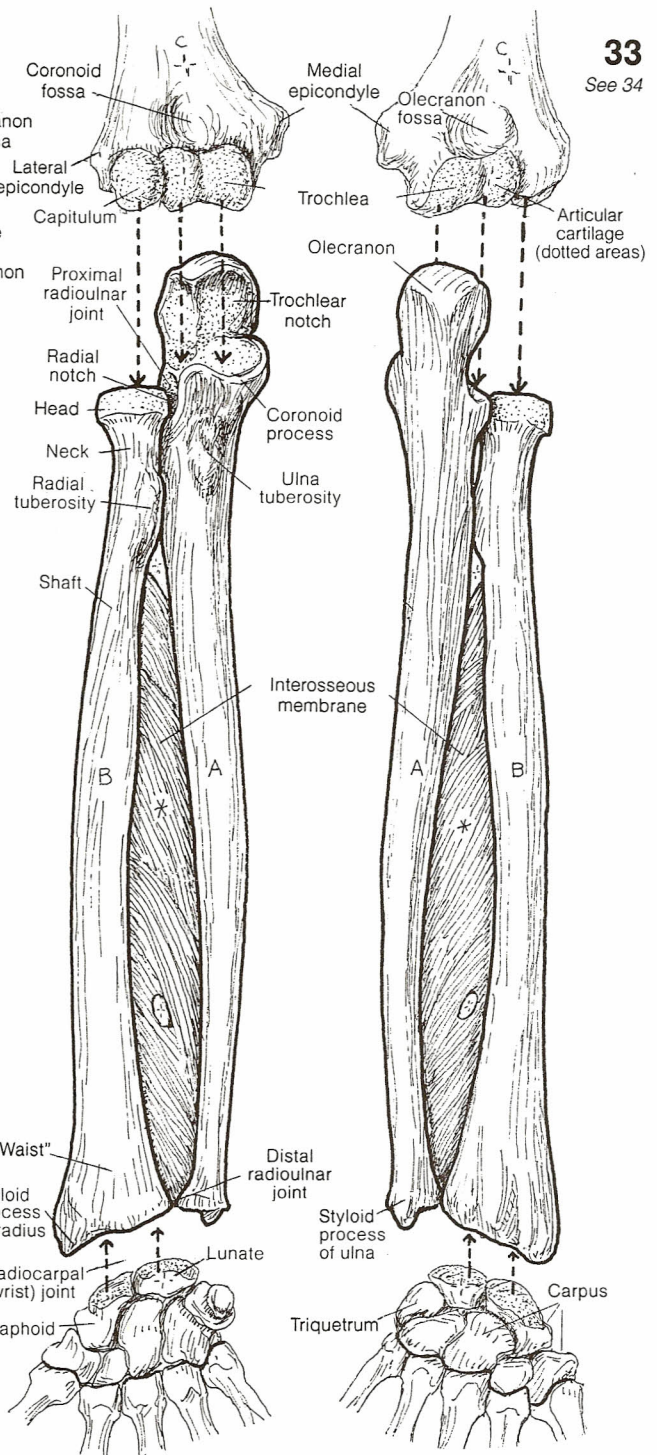
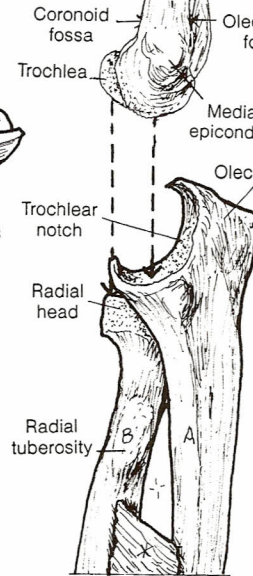
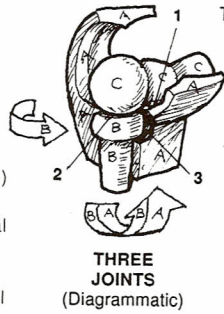


# FOREARM BONES

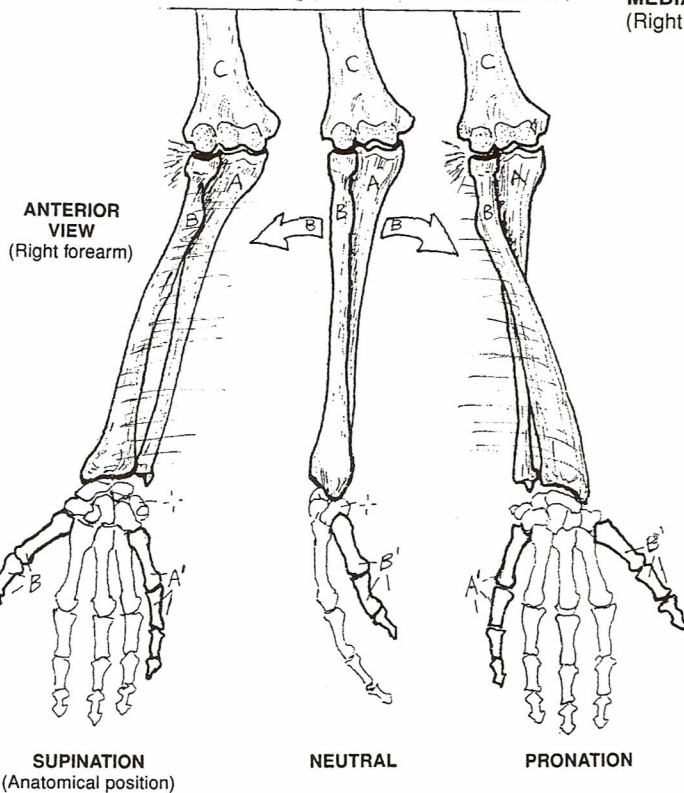
ULNA<sub>A</sub>  
RADIUS<sub>B</sub>

HUMERUS<sub>C</sub>

**CN:** Use very light colors for A and B, and the same color for the humerus (C) that was used on the preceding plate. Note that the distal humerus and carpal bones are left uncolored in the large illustrations. (1) Color the forearm bones in the three views, taking careful note of the callouts referring to surface details. (2) In the supination/pronation diagrams, the thumb and little finger of the hand receive the same colors as the forearm bones to which they relate, regardless of hand position.



RADIUS<sub>B</sub>/THUMB SIDE<sub>B'</sub>  
ULNA<sub>A</sub>/LITTLE FINGER SIDE<sub>A'</sub>



The two bones of the forearm are quite different from one another. The posterior aspect of the proximal extremity of the *ulna* is characterized by a rather massive bone mass called the *olecranon*. You can feel it easily at the back of your elbow. On the anterior side of the olecranon is the *trochlear notch*, which articulates with the *trochlea* of the *humerus* at the *humeroulnar joint* (synovial; hinge). A part of this surface turns to face the *radius* (the radial head); this is the radial notch, which contributes to the *proximal radioulnar joint* (synovial; pivot). The ulnar shaft narrows distally to terminate as the head of the ulna. The head forms a pivot-type, synovial joint with the radius (*distal radioulnar joint*). This joint shares an articular disc that fits between the ulnar head and the lunate and triquetral bones of the wrist. This disc contributes to the radiocarpal (wrist) joint, but the ulnar head does not. The shaft of the ulna forms a movable, fibrous joint (syndesmosis) with the shaft of the radius by means of the interosseous membrane.

The *radius* has a small rounded head proximally, articulating with both

the capitulum of the humerus (*radiohumeral joint*; synovial; pivot) and the radial notch of the ulna (*proximal radioulnar joint*). The shaft of the radius flares distally to form a broad wrist joint with the scaphoid and lunate bones of the carpus. Falls on the hands load the wrist joint and can cause a fracture of the radius at the relatively weak "waist" between the shaft and the flared distal extremity (Colles fracture, Smith fracture).

After coloring and studying the supination/pronation movements, put the palm of your right hand out in front of you, palm down (prone). In this position, the radius and ulna are in parallel. Place the fingers of the left hand on your right olecranon. Now supinate your right hand (to palm up). Notice the olecranon did not move. Thus, the ulna does not move during supination/pronation of the hand. Now find and observe the styloid process of the radius at the right wrist (on the thumb side) as you supinate/pronate the right hand. Note that the styloid process moves with the thumb. You have now demonstrated how the radius moves around the ulna during pronation and supination of the hand.

# ELBOW JOINTS

**CN:** Use the same colors for the three bones as were used on 32 and 33. Use light blue for H. (1) Begin with the three joints of the elbow region. Note that each articulating surface (dotted) receives the color of its bone—in the lower, boxed-in illustration and in the sagittal view, those surfaces (H) are colored light blue. Color K yellow. (2) Color the remaining views of the joint capsule and ligaments.

ELBOW JOINT:  
HUMEROULNAR<sub>B</sub>  
RADIOHUMERAL<sub>A</sub>  
RADIOULNAR<sub>B</sub>

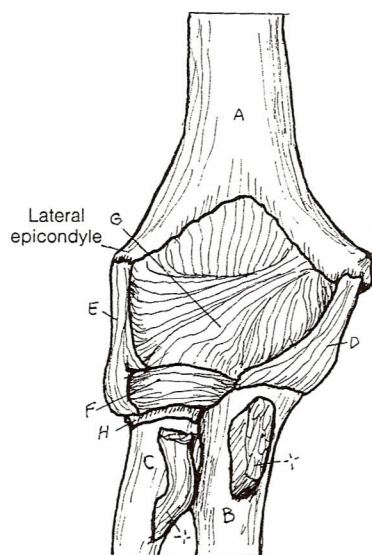
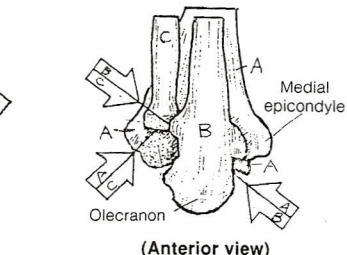
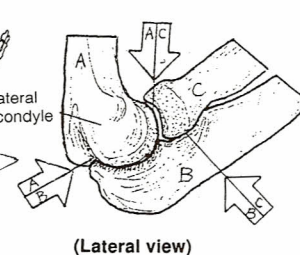
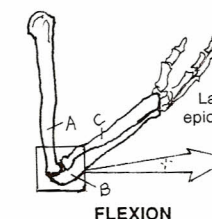
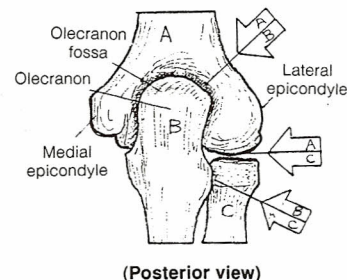
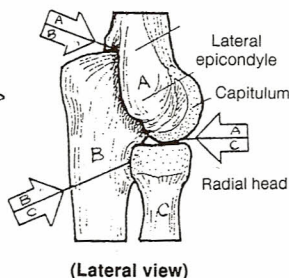
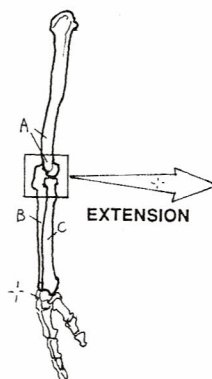
ULNA<sub>B</sub>  
ULNAR COLLATERAL LIG.<sub>D</sub>  
HUMERUS<sub>A</sub>  
RADIAL COLLATERAL LIG.<sub>E</sub>  
RADIUS<sub>C</sub>

JOINT CAPSULE<sub>C</sub>  
ARTICULAR CARTILAGE<sub>H</sub>  
SYNOVIAL MEMBRANE<sub>I</sub>  
SYNOVIAL CAVITY<sub>J</sub>  
FAT PAD<sub>K</sub>  
BURSA<sub>L</sub>

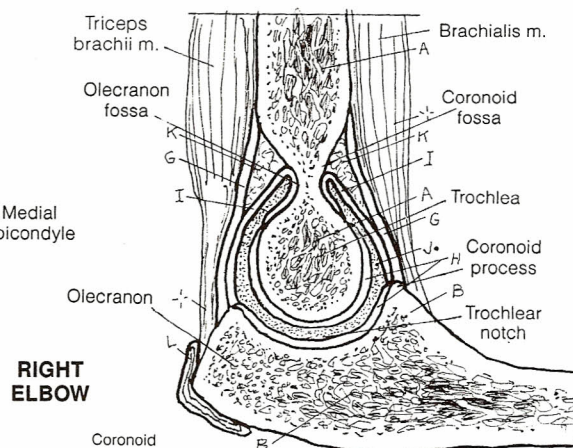
The elbow joint consists of two separate articulations with the humerus: the *humero-ulnar* and *radiohumeral* joints (synovial; hinge type). Movements of this joint are limited to flexion and extension. Note that the C-shaped, articular cartilage-lined trochlear notch of the ulna rotates around the pulley-shaped trochlea of the humerus during these movements. In extension, the upper part of the trochlear notch fits into the olecranon fossa of the humerus (see Plate 33). The ligaments of the elbow joint—essentially, the radial and ulnar collateral ligaments—reinforce the fibrous joint capsule.

The joint between the radius and the ulna (*proximal radioulnar joint*) permits the radial head to pivot within the radial notch of the ulna. The ulna cannot pivot around anything because of the shape of the humero-ulnar joint. Though the proximal radioulnar joint is not considered part of the elbow joint, its synovial cavity and fibrous joint capsule is continuous with that of the elbow joint, and it is secured by both radial and ulnar collateral ligaments. The annular ligament is attached at both ends to the sides of the radial notch of the ulna. It is more narrow below than above (i.e., it is beveled). It surrounds and secures the head (above) and the neck (below) of the radius and resists its displacement when the hand is pulled away from the shoulder. The lower part of the annular ligament is lined with synovial membrane; the upper part is fibrocartilaginous and is associated with the rotation of the radius at the proximal radioulnar joint. The joint capsule and the radial collateral ligament reinforce the retaining function of the annular ligament.

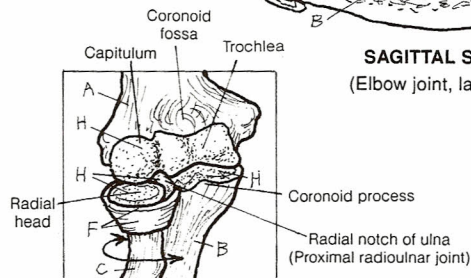
## 3 JOINTS AT RIGHT ELBOW REGION



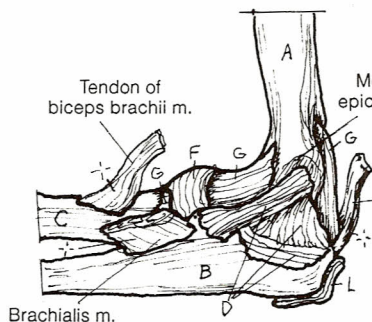
ANTERIOR VIEW



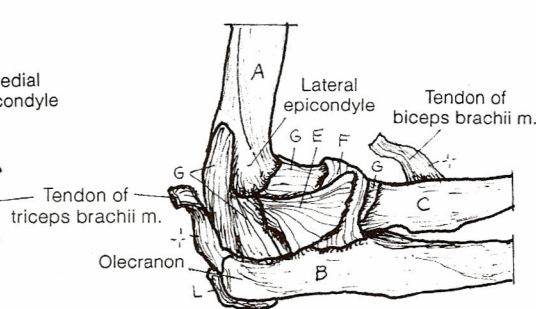
SAGITTAL SECTION  
(Elbow joint, lateral view)



ANNULAR LIGAMENT  
(Diagrammatic)

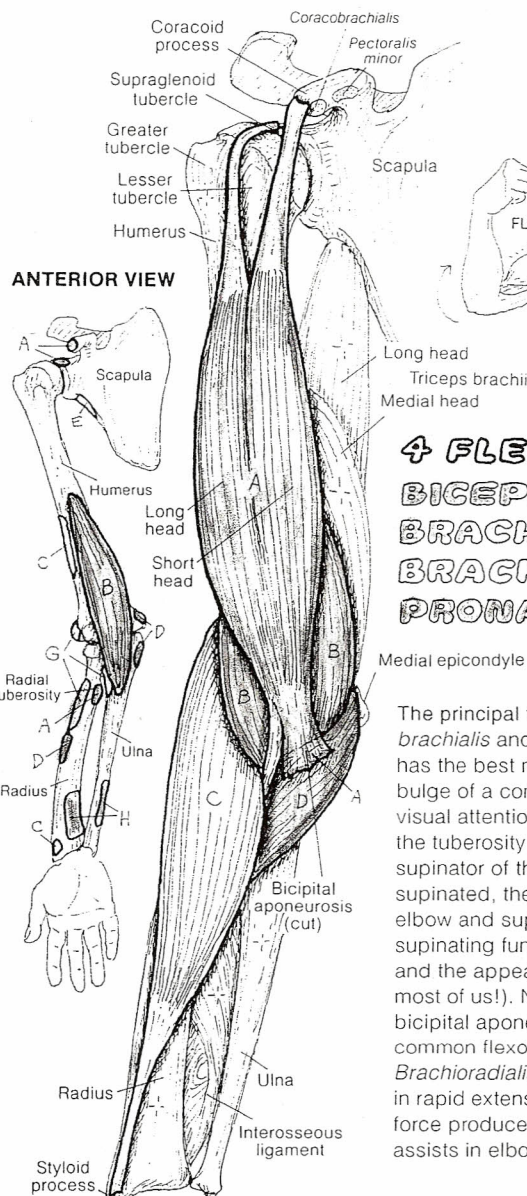


MEDIAL VIEW



LATERAL VIEW

# MOVERS OF ELBOW & RADIOULNAR JOINTS



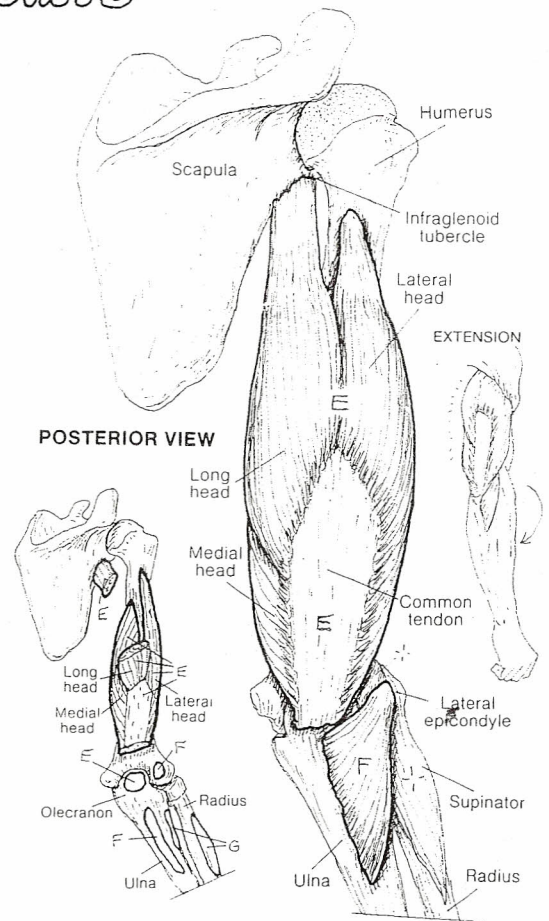
## 4 FLEXORS BICEPS BRACHII<sub>A</sub> BRACHIALIS, BRACHIORADIALIS, PRONATOR TERES.

The principal flexors of the elbow joint are *brachialis* and *biceps brachii*, of which the former has the best mechanical advantage. Yet it's the bulge of a contracted biceps that gets all the visual attention! The tendon of biceps inserts at the tuberosity of the radius, making the muscle a supinator of the forearm as well. With the limb supinated, the biceps works to fulfill flexion of the elbow and supination of the elbow. Take away the supinating function (flexing the pronated elbow), and the appearance of biceps is disappointing (in most of us!). Note the additional attachment of the bicipital aponeurosis into the deep fascia of the common flexor group (not shown) in the forearm. *Brachioradialis* is active in flexion of the elbow and in rapid extension where it counters the centrifugal force produced by that movement. *Pronator teres* assists in elbow flexion as well as pronation.

## 2 SUPINATORS<sub>+</sub> BICEPS BRACHII<sub>A</sub> SUPINATOR<sub>G</sub>

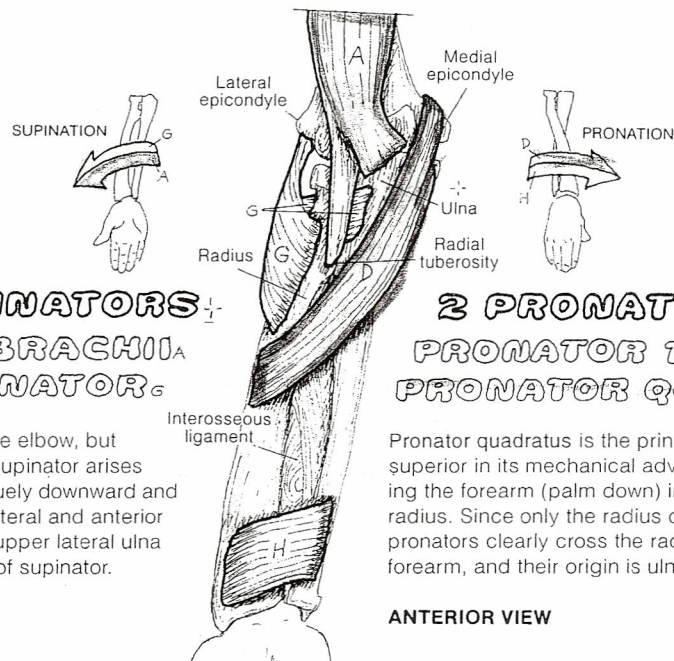
*Biceps brachii* is the more powerful supinator of the elbow, but *supinator* is important in maintaining supination. *Supinator* arises from the lateral aspect of the elbow, passing obliquely downward and forward to a rather broad insertion on the upper lateral and anterior surface of the radius. A bundle of fibers from the upper lateral ulna passes behind the radius to join the lateral fibers of *supinator*.

CN: Use the same colors for *biceps brachii* (A) and *triceps brachii* (E) as you did for those muscles on Plate 56. (1) Color the four flexors and their attachment sites on the drawings to their left. Do the same for the extensors on the right. (2) Color the supinators and pronators below. The arrows demonstrating their actions, and their attachment sites at upper left.



## 2 EXTENSORS<sub>+</sub> TRICEPS BRACHII<sub>E</sub> ANCONEUS<sub>F</sub>

The principal extensor of the elbow joint is the three-headed *triceps brachii* with its massive tendon of insertion. The smaller *anconeus* assists in this function. *Triceps* is a powerful antagonist to the elbow flexors.



## 2 PRONATORS<sub>-</sub> PRONATOR TERES, PRONATOR QUADRATUS<sub>H</sub>

*Pronator quadratus* is the principal pronator of the elbow joint, superior in its mechanical advantage to *pronator teres*. Pronating the forearm (palm down) involves medial rotation of the radius. Since only the radius can rotate in the forearm, the pronators clearly cross the radius on the anterior side of the forearm, and their origin is ulnar.

ANTERIOR VIEW

# MOVERS OF WRIST & HAND JOINTS

## FLEXORS\*

### DEEP LAYER

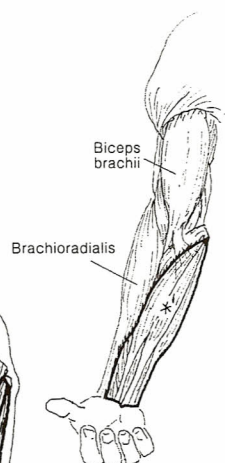
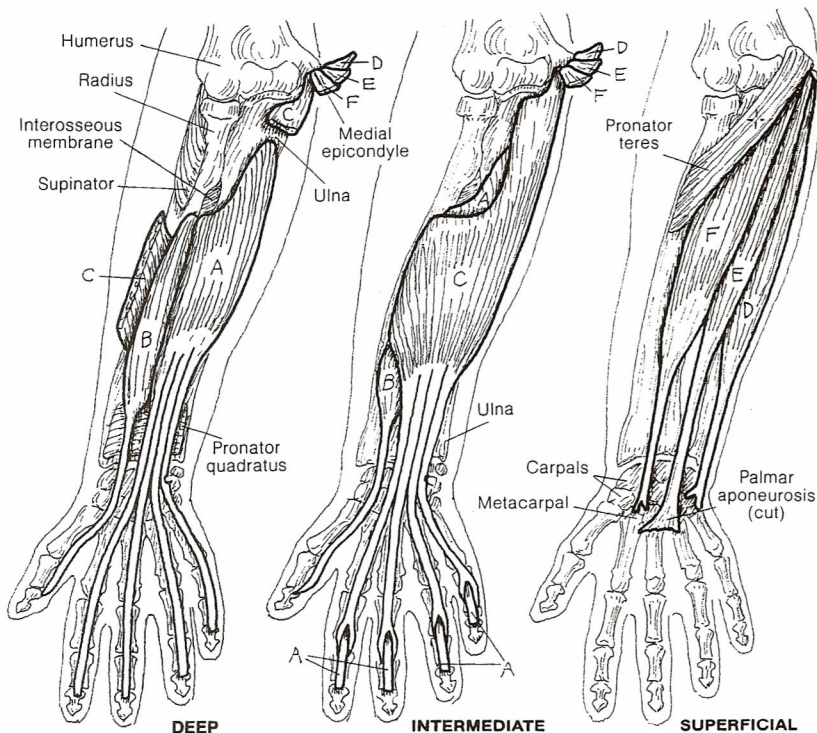
**FLEX. DIGITORUM PROFUNDUS<sub>A</sub>**  
**FLEX. POLLICIS LONGUS<sub>B</sub>**

### INTERMEDIATE LAYER

**FLEX. DIGITORUM SUPERFICIALIS<sub>C</sub>**

### SUPERFICIAL LAYER

**FLEX. CARPI ULNARIS<sub>D</sub>**  
**PALMARIS LONGUS<sub>E</sub>**  
**FLEX. CARPI RADIALIS<sub>F</sub>**



**CN:** A more detailed view of the tendons of these muscles (with the same subscripts) can be seen among the intrinsic muscles of the hand on the next plate. (1) Begin with the flexors; note the deeper muscles have been omitted from the superficial view. Color gray the entire flexor mass in the smaller illustration. (2) Continue with the extensors, coloring gray the entire extensor mass in the smaller illustration.

The flexors of the wrist (carpus) and fingers (digits) take up most of the anterior compartment of the forearm, arising as a group from the medial epicondyle, the upper radius and ulna, and the intervening interosseous membrane. The deep layer of muscles in the anterior forearm (*flexor pollicis longus* or FPL in the radial half, *flexor digitorum profundus* or FDP in the ulnar half) lie in contact with the radius and ulna. The superficial layer of muscles (wrist flexors: the "carpi" muscles and *palmaris longus*) is seen just under the skin and thin superficial fascia. The intermediate layer (*flexor digitorum superficialis*, FDP) lies between the superficial and deep groups. In the anterior (palmar) fingers, note how the tendons of FDS, which insert on the sides of the middle phalanges, split at the level of the proximal phalanges, permitting the deeper (posterior) tendons of FDP to pass on through to the bases of the distal phalanges.

## EXTENSORS\*<sub>2</sub>

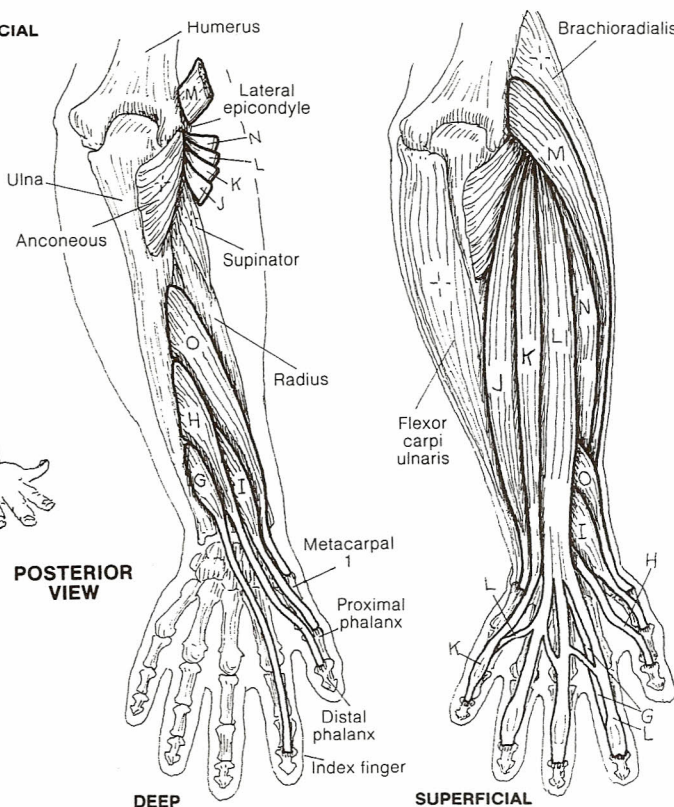
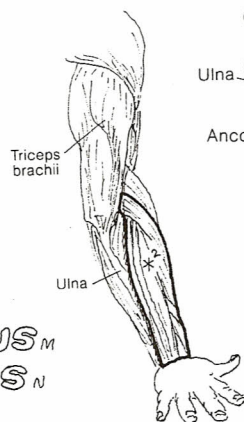
### DEEP LAYER

**EXT. INDICIS<sub>J</sub>**  
**EXT. POLLICIS LONGUS<sub>H</sub>**  
**EXT. POLLICIS BREVIS<sub>I</sub>**

### SUPERFICIAL LAYER

**EXT. CARPI ULNARIS<sub>J</sub>**  
**EXT. DIGITI MINIMI<sub>K</sub>**  
**EXT. DIGITORUM<sub>L</sub>**  
**EXT. CARPI RADIALIS LONGUS<sub>M</sub>**  
**EXT. CARPI RADIALIS BREVIS<sub>N</sub>**

## ABDUCTOR POLLICIS LONGUS<sub>O</sub>



The extensors of the wrist and fingers arise from the lateral epicondyle and upper parts of the bones and interosseous membrane of the forearm, forming an extensor compartment on the posterior side of the forearm. The wrist extensors insert on the distal carpal bones or metacarpals, while the finger extensors form an expansion of tendon over the middle and distal phalanges to which the small intrinsic muscles of the hand insert. The wrist extensor muscles are critical to hand function: grasp a finger of one hand with your fingers and an extended wrist of the other; now try it with wrist fully flexed. Note that the power of the hand exists only with an extended wrist.